WHAT IS A FOOD?

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It is a curious fact that some of the most common and necessary things in life are most difficult to define in concise terms. No short word formula could adequately define love, or home, or life. Similarly, no short word formula can define food.

The principal difficulty which one meets in attempting such a definition is to bring into harmony the results of researches which have approached the subject in question from various directions. It must be evident that a definition which takes cognizance of our chemical knowledge only must be defective; similarly one which should take into consideration simply the influence upon muscular work, or upon the temperature, or upon the action of the nervous tissues, must be defective. In short, a definition of food to be acceptable to scientists in general, cannot be formulated without reference to the best and latest work in the various branches of science which have to deal with foods, and with the nutrition of the body.

The writer will not attempt in this short article to answer the question which stands at its head; his purpose is rather to point out some of the difficulties which stand in the way of a generally acceptable definition, to point out some of the advantages which we of today have over our predecessors in getting a clear concept of a food, and, finally, to make some contribution toward our knowledge of the conditions which a food must fulfill.

In the first place, it will be profitable to hurriedly view some of the numerous definitions of food which have been given:

HOW HAS FOOD BEEN DEFINED?

(1) McKendrick, Dalton and Halliburton give the same definition briefly in the following terms: "Under the term food we include those substances which in the solid or the fluid form are required for the nutrition of the body."

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(2) W. O. Atwater, Professor of Chemistry in Wesleyan University, Connecticut, defines food: "That which, taken into the body, builds tissue or yields energy." (Circ. No. 43. Office of Exp. Station, U. S. Dept. of Agriculture.)

(3) Hammarsten, Professor Physiological Chemistry, in Upsala, University of Sweden: "Those bodies are designated as food which have no injurious action upon the organism, and which replace those constituents of the body that have been consumed in the exchange of material (metabolism) or that can prevent or dimish the consumption of such constituents."

(4) Gould, compiler of the Medical Dictionary, defines food as "Anything used for the nourishment of or formation of tissue," and defines nourishment as "Anything that enters into the formation of living tissue."

(5) Howell, Editor of the American Text Book of Physiology and Professor of Physiology, Johns Hopkins University, defines food thus: "What we eat and drink for the purpose of nourishing the body constitutes our food. . . . The food is utilized to repair the wastes of the body, i. e., the destruction of the body material which goes on at all times. . . . It serves as the source of heat, mechanical work and other forms of energy liberated in the body."

(6) H. Newell Martin, Professor of Biology, Johns Hopkins University, in his text-book of Anatomy and Physiology for Colleges ("Human Body, Advance Course") thus defines food: "Foods may be defined as substances, which, when taken in to the alimentary canal, are absorbed from it, and serve either to supply material for the growth of the body, or for the replacement of material which has been removed from it, either after oxidation or without having been oxidized." Dr. Martin follows up this definition with a series of conditions which the food must fulfill: (1) A food must contain what it is to replace in the body either in the form of such substances, or in forms which the body can build up into them. (2) It must be absorbable. (3) Neither the substance itself nor any of the products of its transformation in the body must be injurious to the structure or activity of any organ. If so it is a poison, not a food."

(7) Seneca Egbert, Professor of Hygiene, and Frank Woodbury, Professor of Therapeutics, in the Medico-Chirurgical College of Philadelphia, have just formulated this definition: "A food is any substance which, when taken into the living human body, is capable—usually after being subjected to the action of digestive organs—of entering

through the absorbent vessels into the general circulation and of supplying assimilative material and potential energy to the cellular elements of the tissues, and of promoting normal metabolism and general bodily health."

It affords material for much thought simply to study these definiitons with reference to their source and the time at which they were formulated. Note, for example, how simple a definition satisfied the older physiologists, McKendrick and Dalton; while the later physiologists and biologists, as represented by Howell and Martin, limit the foods clearly to those substances which can be assimilated or built up into living tissue. Halliburton and Hammarsten represent the physiological chemists. One of them evidently accepts the definition of the physiologists of his day, while the other, writing last year, redefines food from his own standpoint, and in such terms as to include all the generally recognized foods, but takes especial care to exclude substances which may possess some of the characteristics of food but which have an injurious effect upon the system. The definition of Atwater of Wesleyan could not be accepted by a physiologist, a biologist or a specialist in hygiene or therapeutics because it would include all substances which may be oxidized within the body. Now phosphorus would be oxidized within the body and would yield energy. The same is true of numerous ptomaines, leucomaines and toxines; of morphine, muscarine, and alcohol. Professor Atwater evidently realizes the weakness of this definition and follows it immediately with the statements: "The most healthful food is that which is best fitted to the wants of the user. The cheapest food is that which furnishes the largest amount of nutriment at the least cost. The best food is that which is both most healthful and cheapest."

Taking these statements altogether, we understand Professor Atwater to say in effect: Phosphorus and alcohol and all of those ptomaines, leucomaines, toxines and alkaloids which are oxidized in the body, are foods because their oxidation would yield energy to the body but they are most expensive foods, hundreds of dollars' worth of some of them not representing enough energy to keep the body warm one day, and they are most unhealthful foods, a few grains of some varieties being sufficient to cause death.

Thus a legitimate interpretation of Prof. Atwater's definitions leads us into the most pitiable absurdities. In a similar way any definition of food so framed as to include alcohol is certain to lead to absurdities and inconsistencies.

The best definition of food will be the one which takes into account the widest range of facts regarding it. Of the definitions quoted above those of Howell, Martin and Egbert and Woodbury are in perfect harmony. They represent the ideas of specialists in physiology, biology, hygiene and therapeutics.

NATURE'S DEFINITION OF A FOOD.

It is probable that in no other concept which man may wish to define does he get so much assistance from nature as in the case of the term food. In fact, nature gives a very clear cut and unambiguous definition of a food. Fortunately, she repeats this definition for every different branch of the plant and animal kingdom, so that there shall be no misunderstanding.

Nature says that the food for young mammals shall be milk. What is milk and what office does it serve in the body of the young mammals? Milk consists of two kinds of protein, of fat, milk sugar, inorganic salts and water. It is digested, absorbed, and assimilated by the living cells of the young growing body, and built up by them into living cell protoplasm. Incident to the vital processes of the young mammal, portions of the cell substance are constantly being catabolized, or decomposed into simple substances. Oxygen plays an important role in this catabolism, and energy is liberated in the form of heat, or mechanical motion, or nervous energy, or secretory energy. Under the influence of this food the young mammal increases in size and strength.

Nature says that the food for young birds, reptiles, frogs, and fishes shall be eggs. Eggs consist of protein, of fats, of inorganic salts and water. Egg material is able to furnish all that the young bird, reptile, frog or fish needs for the early stages of his growth and development. The protein furnishes the nitrogenous compounds necessary for building up the active portion of every living cell, while the fat furnishes a non-nitrogenous portion of food, also taken within the cells of the growing animal and used there, by the living protoplasm of the cells. Eventually it is oxidized and yields its energy to the body as active heat or motor energy.

Nature's food for the young corn-plants shall be the matter stored away in the corn-grain by the mother-plant. This food consists of proteins, carbohydrates, fats, inorganic salts and water.

For the different organisms mentioned above nature supplies only one source of food. The young mammal has no alternative. It must

take milk or starve. The young bird or reptile must take egg or nothing. Now, when we subject the animal body to chemical analysis we find that it is composed of water and solids; we find that the solids are in turn composed of organic and inorganic compounds; the former comprising proteins, carbohydrates, fats, with various extractives representing products of tissue decomposition not yet excreted from the system when the animal met death. The inorganic salts represent the mineral matter of the bones, the salts of the blood and lymph, as well as those of the tissues in general. If we make analysis of various animal organisms we shall find the tabulated results strikingly similar for all classes, of animals. If we make analyses of various foods which nature provides for the young of these various animals we shall find (1) that there is a striking qualitative similarity in the analyses; and (2) that the food analyses are strikingly similar to the analyses of the animals which they are to nourish; whose tissues they are to build up or to repair.

These coincidences are not the result of chance. Nature follows laws graven in the very foundation of living matter. Protoplasm can use as food only substance which it can bring within its cell walls as a constituent of cell-sap, or cytolymph. Though the food-stuff forms a portion of the cytolymph of the cell, it must still undergo anabolic or assimilative changes before it becomes a part of the living, moving, active, spongioplasm of the cell.

Are we now in a position to define a food in harmony with nature's definition? Such a definition must meet the approval of biologists and physiologists at least. Let us not attempt a brief word formula, but simply state a few of the conditions which a food must satisfy.

1. A food must be digestible and absorbable by the organism which it is to nourish.

2. A food must be assimilable by the living cells of the organism which it is to nourish. By these cells it is first made a constituent of the cytolymph, where it is held in temporary reserve for use by the acting, moving, spongioplasm, or, perhaps, by the nucleus of the cell.

Incident to the assimilation of a food it will build up new tissue. It is customary for physiologists to differentiate between the building up of new tissue and the repair of old tissue. This distinction is wholly gratuitous and unnecessary. New protoplasm is being built from the foods of each meal, old protoplasm is being catabolized or decomposed constantly. If the new protoplasm formed balances the old protoplasm decomposed, it is said that "the repair balances the waste." If

the accretion exceeds the excretion, it is said that "the wastes are repaired and there is a balance for growth."

3. All assimilated foods, i. e., all living tissue, undergo catabolic changes accompanied by oxidation. This is nearly the equivalent of saying all assimilated foods are oxidized within the body; yet there is an important technical difference which makes the first statement more acceptable to the physiologist.

4. All of the energy which the animal organism has at its disposal is liberated incident to the catabolism of assimilated foods.

5. The energy which a food supplies must be liberated at such a time and place as to be beneficial and advantageous to the organism.

6. No substance can be recognized as a food which is not properly absorbable and assimilable, and whose catabolism or oxidation is not so controlled in time and place (i. e., co-ordinated) as to be advantageous to the system.

Let me quote the great physiological chemist Bunge* on this point: "It is not enough to prove that potential chemical energy is changed into kinetic energy. The oxidation must take place at the right place, i. e., at exactly the right stage in the activity of particular tissue-elements. It must be demonstarted that the kinetic energy liberated can be utilized in the performance of a normal function."

*Physiologische und Pathologische Chemie., 1894, pg. 124.

IS ALCOHOL A FOOD?

A REPLY TO PROF. W. O. ATWATER.

In order to answer intelligently the question, "Is Alcohol a Food?" it will be necessary to have at command as much knowledge as possible on both food and alcohol.

About a half century ago Liebig, the "father of physiological chemistry," divided foods into two classes: (1) the "plastic foods," or those which may be built up into active muscle, gland or nerve tissue; (2) the "respiratory foods," or those which are oxidized in the blood to liberate the heat energy of the body. The first class of foods included the nitrogenous proteids, while the second included the non-nitrogenous carbohydrates and fats. Liebig believed that the muscle tissue assimilated only the nitrogenous portion of the food, and that with each muscular movement a portion of the muscular tissue would be broken down or decomposed. Such being the case, the nitrogenous excreta of the urine ought to be proportional to the mechanical muscular energy liberated in a given period.

This theory was accepted without question for a considerable period, but finally the young physiologist, Fick, and the young chemist, Wislicenus, decided to put Liebig's theory to a practical test. It is not necessary to describe their experiment here, but it is important to know that these experimenters found that Liebig's theory was entirely wrong. Subsequent work on the same problem by Voit and Pettenkoffer, and by Pfluger and his pupils demonstrated that when muscles are fed with sufficient carbonaceous food they are able to produce a prodigious amount of both mechanical and heat energy with only slight modification of the usual and average nitrogenous excretion. They demonstrated further that the elimination of CO_2 varies with the muscular work done.

So Liebig's theory of muscle metabolism fell to the ground. His theory that meat extract (Liebig's Fleisch Extract) contained nutri-

ment for muscle tissue was also proven to be untenable. His definition and classification of foods went into disuse because they were no longer in harmony with what was known about the action of living tissue.

Among other theories which the father of physiological chemistry advanced was the one that alcohol is a food. He reasoned thus: All respiratory foods are oxidized in the body; alcohol is oxidized in the body; therefore, alcohol is a respiratory food. Of course the fallacy here is apparent.

During the half century which has elapsed since this theory was first advanced the question of the food value of alcohol has been under almost continuous controversy.

In a large proportion of the text-books on physiology and therapeutics, even down to the present time, one will find under "alcohol" some such statement as this: "If oxidized even to a small extent alcohol must be regarded in the scientific sense as a food."—(McKendrick, Special Physiology, pg. 19.) "Alcohol is oxidized in the body and is thus within narrow limits a food."—(Halliburton, Chemical Physiology and Pathology, pg. 600.)

From these statements, which are practically the same as one will find in most of the older physiologies, it is evident that the writers reasoned that everything oxidized within the body must be food. The fallacy of such a position is shown in the article above on "What is a Food?" If everything that is oxidized within the body, yielding, incident to that oxidation, energy which is added to the body-energy, is to be classed as a food, then we must rank among the foods: Phosphorus, certain ptomaines, leucomaines and toxines, also alcohol.

It is interesting to note that the physiologists above referred to, who, when discussing alcohol, admit that it is "techincally a food," or that it is "a food within narrow limits," do not enumerate alcohol in their list of foods, nor do they classify it among the foods. Some list it with food-accessories (Genussmittle), along with: mustard, pepper, coffee, tea, spices, etc.

When one takes up the more recent works on physiology, or pathology, or therapeutics, he is likely to find some very interesting reading on this subject. For example, H. D. Rolleston, M. D., Lecturer on Pathology, St. George's Hospital, writing in Allbutt's System of Medicine (Vol. III., pg. 839 et seq.), says, within the limits of one page: (1) "In physiological quantities, alcohol may be considered as

a food inasmuch as it is used up in much the same way as carbohydrates and leaves the body as CO_2 and H_2O." (2) "As with other poisons or drugs, there is no constancy in the dose of alcohol which produces distinct results, or of the character of the effect in different persons." (3) "The nervous system, being unstable (in hereditary alcohol-taint) needs but little of the noxious poison (alcohol) to disturb its balance and to precipitate a condition which might be compared with temporary insanity."

The interesting feature is that the author did not seem to see any inconsistency between the ideas, "food" and "poison." Many of the recent writers on therapeutics and pathology have been led into this inconsistency, probably through incorporating the statements of some of the older physiologists along with their more up-to-date knowledge of the pharmacology and pathology of alcohol.

As already urged in the article on "What is Food?" any proper and acceptable answer regarding the food value of a substance must consider (1) its influence upon the inner activities of the living tissue cells; and (2) its total influence in the body from the time it is ingested until its last decomposition product is excreted from the body.

It is very evident in the writings of such representative modern physiologists as Foster, Bunge, Schaefer, Howell, Tigerstedt and Lee, that they conceive all of the ultimate life processes to be within the cell. All of these men treat the chemical processes of cell-life extensively in their works on physiology and physiological chemistry. None of these men call alcohol a food, and none of them admit that it has even a "limited food-value."

There is a good deal of misinterpretation and misapprehension regarding the significance of certain of the effects of alcohol upon vital activity of the cells. It has been determined, for example, that after the ingestion of alcohol the excretion of carbon-dioxide is diminished. This is accompanied by an accumulation of the carbonaceous materials of the body, and the actual deposit of fat or a sparing of proteid material, one or the other of these latter effects being certain to follow any cause which will decrease the excretion of carbon-dioxide. Many jump at once to the conclusion that any substance which can cause a sparing of proteid or of fat or both must of necessity be a food. But that conclusion does not by any means follow. There is a very closely veiled fallacy in the course of reasoning which leads to such a conclusion, and many have passed it by without recognizing it. That

is especially the case with those who take account of ingesta and egesta alone without trying to follow the changes which take place within the cells.

Let us unveil the fallacy. Under conditions of normal activity a cell will catabolize,—or, we may say, oxidize,—a certain amount of matter drawn immediately either from the cell-sap or from the living cell-substance itself. This matter is in part nitrogenous and in part non-nitrogenous. All food is "tissue-building" in its assimilation, and all food is "energy-liberating" in its oxidation. To arbitrarily differentiate between tissue-building and energy-liberating is wholly unwarranted in the light of modern research in cell physiology. So the cell under normal conditions will oxidize a certain amount of its matter. This oxidation will yield the energy required for the vital processes, and will also yield certain products of decomposition. The non-nitrogenous molecules, will, on oxidation, yield carbon-dioxide and water; while the nitrogenous molecules will yield carbon-dioxide, water and urea (or allied nitrogenous excreta).

Let us suppose that the cell is in a condition of carbon and nitrogen equilibrium, i. e., that it gives out daily in its excreta an amount of carbon and nitrogen equal to that of the food which it assimilates. If under these conditions a little more food be absorbed by the cell, one or the other of two things will happen: (1) either there will be greater cell-activity (muscular, nervous or secretory) with a correspondingly greater output of CO_2 with some increase in the nitrogenous excreta; (2) or there will be an accumulation of fat or protein within the cell. The cell-activity being governed by the central nervous system rather than by the simple presence of increased food, the second alternative will be the one almost uniformly observed. That is, if we give more food we will get an accumulation of the excess as a reserve.

Now suppose that without any excess in the food supply the central nervous system causes a decrease of cell activity throughout all of the active tissues, there will be an accumulation of unused food materials within the active cells or within the storage tissues.

This nervous influence upon the oxidation of food materials may be produced by morphine. After the administration of morphine there will be an accumulation or a "sparing" of both carbonaceous and protein food materials, or tissues, provided the ingested food is normal in amount. Boecker (Breitrage zur Heilkunde, S. 181) found by experiments upon dogs that after the animals were brought into a condition

of nitrogen equilibrium the administration of morphine with the food in a quantity to produce its typical physiological effect (not lethal doses) caused the proteid catabolism to be decreased 6 per cent, while the consumption of Oxygen was decreased 34 per cent and the excretion of CO_2 was decreased 27 per cent.

If we were to take into account simply the balance of ingesta and egesta we might reason thus: (1) The addition of food to an animal in C and N equilibrium leads to an accumulation of C and N in reserve, all other things remaining the same. (2) The addition of morphine to the food of an animal in C and N equilibrium leads to an accumulation of C and N in reserve, all other things remaining the same. (3) Therefore, morphine must be a food.

The fallacy of this reasoning is apparent only when we take into consideration the vital process of the cell. Morphine depresses the activity of the cell, oxidation is decreased, less cell-substance is decomposed, the amount of matter absorbed remaining the same, there must be an accumulation of C and N in the cell. Notice the difference between the two cases: With increased food the activity remains the same or is increased and the result is an accumulation of C and N or greater activity with increased CO_2 and N excretion. With the influence of morphine, the activity is always decreased, and the excretion of C and N is always decreased. With both there is an accumulation of food materials or of cell substance; thus the final chemical effect of morphine is similar to that of increased food ingestion. But the total effect upon the vital processes within the cell is as nearly opposite as it is well possible to be: Increased activity and increased excretion with increase of food; but decreased activity and decreased excretion with morphine.

Morphine is a narcotic. All narcotics depress vital activity. Brunton, Cushing, Blyth, and all the newer authorities on pharmacology and toxicology, agree that alcohol is a narcotic in both small and large doses. All who have experimented with alcohol in its relation to the output of CO_2 agree that that is diminished. This result is in perfect harmony with the general narcotic effect, and simply means that cell activity is diminished.

To demonstrate that alcohol "spares carbonaceous and protein foods and tissues," is simply to prove that it is narcotic in its effect upon cell activity unless it can be demonstrated that the consumption of oxygen and the output of CO_2 are either normal or increased. But

these gases are always decreased in their interchanged, after ingestion of alcohol in even moderate quantities. Alcohol cannot then be a food; it is a narcotic.

Listen to the testimony of Austin Flint* upon this question: "The immediate effects of the ingestion of a moderate quantity of alcohol, continued for a few days, are decided. It notably diminishes the exhalation of CO_2 and the discharge of other excreta, especially urea. Proper mental and physical exercise and all conditions which favor the vigorous nutrition and development of the organism physiologically increase rather than diminish the quantity of the excreta. They correspondingly increase the demand for food, and if continued are of permanent benefit. Alcohol, on the other hand, diminishes the activity of the nutrition."

Rolleston† says that "alcohol forms with the haemoglobin of the red blood corpuscles a compound which takes up and parts with oxygen less readily than normal haemoglobin. This leads to a general diminution in the metabolism of the body and as a result the amount of fat in the body may become increased. * * * Partly as a result of its action as a functional poison on the tissues of the body (especially the nerve cells, mentioned in an accompanying paragraph) and partly from its influence on haemoglobin, the metabolism of the tissues is diminished by alcohol."

In the experiments performed by Professor Atwater and described in Bul. No. 69 of the Bureau of Experiment Stations, the alcohol given was not sufficient in quantity to have any marked effect upon proteid metabolism. There was a slight loss of proteid, which may or may not have been due to the influence of alcohol upon the system. Professor Atwater said regarding this point: "There is nothing in the experiments which favors alcohol or is opposed to alcohol as a protector of proteid." Now there is a very good reason for this failure to get positive results regarding the influence of alcohol on proteid metabolism. In the description of experiment No. 5 (all of the experiments were alike in this respect) this statement appears: "Three hundred grammes of warm coffee infusion were served with each meal; it was prepared in the usual way." (Bul. 69, pg. 32.) "The coffee infusion * * * contained practically no nitrogen,—amounting to less than 0.2 gram. of nitrogen for the whole experiment * * this quantity

*Textbook of Physiology, 1893, pg. 176.

†H. D. Rolleston, M. D., F. R. C. P., Lecturer on Pathology, St. George's Hospital, London, in Allbutt's System of Medicine, Vol. III, pg. 839.

has been ignored and the coffee infusion has been considered simply as so much water." The physiological effect of a liter of coffee per day,—a large cupfull or two smaller cupfulls at each meal,—"ignored," because it contained little nitrogen! Morphine and strychnine contain nitrogen. Quantities of these substances sufficient to produce a profound effect upon the system would contain an amount of nitrogen which would be infinitesimal compared with above quoted 0.2 gm. This infinitesimal quantity of nitrogen could be ignored chemically without introducing any appreciable error in the material debits and credits of the body. Can the influence of morphine, or strychnine or caffein be ignored physiologically because they contain an amount of nitrogen (or carbon or hydrogen) so small that it may be ignored when compared with a total of several hundred grammes?

Coffee is a physiological antagonist of alcohol. When the two are given simultaneously, we need not be surprised that the results are ambiguous.

Commenting upon this point, Professors Woodbury and Egbert* said: "As therapeutists, however, we may express surprise that Professor Atwater entirely ignores the physiologic effects of 300 c. c. of infusion of coffee, given three times a day, as regards especially its influence on nutrition, * * * and that he counts it only as so much water. * * * There are many individuals in the community, we are convinced, whose nutrition would be seriously affected by one or two cups of coffee taken three times a day, and it might be well to repeat this series of experiments, leaving out this disregarded but disturbing factor in the problem."

SUMMARY.

1. Half a century ago Liebig classified alcohol as a food because it is oxidized in the body. Even to the present day many physiologists and therapeutists ascribe to alcohol, "a certain food value," under particular conditions (fevers, exhaustion and certain other pathological conditions).

2. None of the more recent physiologists enumerate alcohol among the food-stuffs.

All authoritative works on toxicology classify alcohol as a narcotic poison.

*"A Physiological Consideration of the Food Value of Alcohol." By Frank Woodbury, M. D., and Seneca Egbert, M. D., of Philadelphia. In Journal American Medical Association of Mar. 31st, 1900.

All authoritative works on the physiologic action of drugs state that alcohol is a narcotic, and that the stimulation attributed to it is only apparent and due to narcosis of inhibitory or controlling centres.

3. Physiologists believe that all of those nutritive processes which involve construction of simpler bodies into complex ones with consequent making-latent of energy, also those which involve a decomposition of complex bodies into simpler ones with accompanying oxidation and a liberation of energy,—all take place within living cells, i. e., within living protoplasm. The protoplasm itself is replenished by the anabolic processes and wasted or decreased by the catabolic processes.

4. Various toxic substances are oxidized in the body; just where or how they are oxidized nobody seems to know. Among these toxic substances are alcohol, morphine, certain ptomaines, etc.

This oxidation results in a liberation of a certain amount of energy which is added to the heat of the body. In this respect alcohol is similar to the foods.

All food is tissue-building in its assimilation, and all food is energy-liberating in its oxidation.

Nobody maintains that alcohol, or morphine or oxidizable toxins are assimilable, or are capable of building tissue.

5. Fat is stored whenever the food ingested is in excess of material egested. There may be an excess of ingesta leading to a deposit of fat under two conditions: (1) cell-activity unchanged or even increased and food moderately or considerably increased; (2) food-quantity unchanged and cell-activity decreased. Fat deposit with increased elimination of CO_2 will follow condition No. 1; fat deposit with decreased elimination of CO_2 will follow condition No. 2. Narcotics cause decreased cell-activity, and decreased elimination of CO_2.

Alcohol possesses this feature in common with the other narcotics, and is usually accompanied by an accumulation of fat, and may, under usual conditions, be accompanied by a decrease of nitrogen elimination, i. e., by a "sparing of proteid."

Food exerts upon cell metabolism an influence which is the reverse of that exerted by alcohol.

6. Finally, we may answer the question which stands at the head of this paper, in the most unequivocal terms: **Alcohol is not food. Alcohol has no "food value." Alcohol is not to even a "limited extent" a food. Alcohol is not in any sense, especially the "scientific sense," a food.**

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